WATER OF HYDRATION

Objective:

- To use percent composition calculations to determine the percentage of water in barium chloride.
- To determine the number of moles of water in barium chloride hydrate.

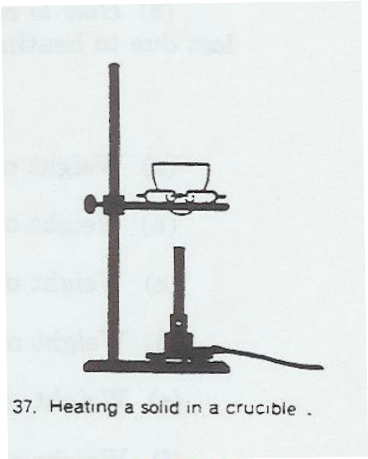
A. What is the percentage of water in barium chloride crystals?

Procedure:

Preparing the crucible and contents:

1. Clean and thoroughly dry a porcelain crucible over a blue flame. Let it cool and then weigh it accurately.

2. Fill the crucible about half full of barium chloride crystals and again weigh accurately the crucible and its contents.



37. Heating a solid in a crucible .

Driving water out of the crystals:

3. Support the crucible containing the crystals on a pipe-stem triangle (see diagram 37). Heat it gently at first, and gradually increase the heat to the full intensity of the flame. Heat it strongly for about 10 minutes.

4. Then let the crucible and its contents cool on the pipe-stem triangle, or in a desiccator if one is available. Again weigh accurately the crucible and its contents.

Heating to constant weight (if time permits):

5. Repeat the heating for about 5 minutes, cool, and weigh again. Repeat this process until the weight has become constant. This repeated operation, called "heating to constant weight," insures that all the water has been driven out of the crystals.

Data and Calculations:

(a)Weight of crucible and crystals	
(b)Weight of empty crucible	
(c)Weight of crystals	
(d)Weight of crucible and anhydrous $BaCl_2$	
(e)Weight of anhydrous $BaCl_2$	
(f)Weight of H_2O lost	
(g)Determined percentage of H_2O (by experiment)	

Calculations:

List several possible chances for error in this experiment.

B. What is the correct formula for barium chloride hydrate?

In order to be able to write the correct formula for the barium chloride crystals you have used, you must know the number of moles of water that is combined with each mole of anhydrous $BaCl_2$. You can write the formula of the hydrate like this, $BaCl_2 \bullet x\ H_2O$, letting *x* represent the number of moles of H_2O that should be shown in the correct formula.

You do not yet know the value of *x*, but you do know that *x* multiplied by 18g (one mole of H_2O) represent the total weight of H_2O present in one mole of the crystals. You also know that:

Actual weight of H_2O (g): $18\ x$ g = actual wt. $BaCl_2$ (g) : mole $BaCl_2$ (g)

Calculate the weight of one mole of $BaCl_2$, substitute it and the values from your preceding data table for the actual weight of H_2O (f in the data table) and for the actual weight of anhydrous $BaCl_2$ (e in the data table) in the proportion, and solve for *x*:

The correct formula of $BaCl_2$ hydrate is:

Be prepared to show that you can also determine the value of x from this proportion:

$$\frac{x\ H_2O\ (g)}{\text{moles } BaCl_2 + x\ H_2O} = \frac{\text{loss of weight (g)}}{\text{weight of hydrate (g)}}$$